Journal of Cereal Research

Volume 15 (2): 273-276

Homepage: http://epubs.icar.org.in/ejournal/index.php/JWR

Research Article

Effect of integrated nutrient management on growth and yield of wheat (*Triticum aestivum* L.) under system of wheat intensification

Chandanpreet Kaur[1], Santosh Kumar[2] and Karanbir Singh[1]

Department of Agriculture, Mata Gujri College, Fatehgarh Sahib – 140 406

[1]Government Employee, Department of Horticulture, Kheti Bhawan, Mohali, Punjab.

[2]Assistant Professor (Agronomy) Department of Agriculture, Mata Gujri College, Fatehgarh Sahib, Punjab

[3]Student, Mata Gujri College, Fatehgarh Sahib

Article history:

Received: 04 Feb., 2023

Revised: 31 May, 2023

Accepted: 11 Aug., 2023

Citation:

Kaur C, S Kumar and K Singh. 2023. Effect of integrated nutrient management on growth and yield of wheat (*Triticum aestivum* L.) under system of wheat intensification. *Journal of Cereal Research* ***15 (2):*** *273-276. http://doi.org/10.25174/2582-2675/2023/120083*

****Corresponding author:***

E-mail: chandanpreetKaur08@gmail.com

Abstract

A field experiment was carried out at Experimental Farm, Department of Agriculture, Mata Gujri College, Fatehgarh Sahib at Shamsher Nagar during the season of Rabi crops 2017-18 on effect of integrated nutrient management on yield of wheat (*Triticum aestivum* L.) under system of wheat intensification which was conducted during M.Sc. thesis. The study exposed the effect of integrated nutrient management on yield of wheat (*Triticum aestivum* L.) under system of wheat intensification. The experiment was laid out in a randomized block design with three replications having eleven treatments *viz.,* T_1 - Control, T_2 - 100 % RDF, T_3 - 75 % RDF + FYM @ 5 tha^{-1}, T_4 - 75 % RDF + vermicompost @ 2.5 tha^{-1}, T_5 - 75 % RDF + FYM @ 5 tha^{-1} + Vermicompost @ 2.5 tha^{-1}, T_6 - 75% RDF + *Azotobacter* @ 5 $kgha^{-1}$, T_7 - 75% RDF + PSB @ 5 $kgha^{-1}$, T_8 - 75% RDF + *Azotobacter* @ 5 $kgha^{-1}$ + PSB @ 5 $kgha^{-1}$, T_9 - 50% RDF + Vermicompost @ 5t/ha, T_{10} - 50% RDF + Vermicompost @ 5t/ha + *Azotobacter* @ 5 $kgha^{-1}$ + PSB 5 $kgha^{-1}$, T_{11} - 50% RDF + FYM @10 tha^{-1}. The results revealed that higher growth parameters *viz.,* number of tillers , plant height, LAI and dry matter accumulation were recorded under treatment fifth which was at par with eighth and tenth treatment and it was significantly predominant over the other treatments at all stages except 30 DAS. Further, yield parameters, yield was also higher under the same treatments as mentioned in growth analysis.

Keywords: *Azotobacter,* Vermicompost INM, SWI and yield parameters

1. Introduction:

Wheat (*Triticum aestivum* L.) is the world's most widely cultivated food crop. It is staple food not only India but near about 65 % Asia pacific population. It is a second most important staple food after rice. It can be grown from sea level for 5000 m altitude and in area where annual rainfall ranges from 300- 1130 mm. Wheat grain contains more proteins than other cereals which are of special significance to maintain the good bread making quality due to the presence of a characteristic substance 'gluten'. It has also a relatively high content of niacin and thiamine.

Wheat is an imperative cereal crop for many countries in the world. It contribute about 20% to the total food calories for the humanity. It is the world's most widely cultivated food crop. Wheat grains contain nearly 12% proteins, 2.7% minerals, 2% fiber, 1.7% fat, 60-70% carbohydrates (Prasad, 2015). The availability of wheat has increased from about 79 g per capita per day to more than 185 g per capita per day despite the doubling of population since 1961 (Bhardwaj *et al.* 2010). System of wheat intensification (SWI) is an adoption technique used in system of rice intensification (SRI) methodology for increasing productivity of the crop by management of plant, soil, nutrients and water while reducing external inputs. The technology which has high potentiality to provide high yield per drop of water and kg^{-1} of agricultural inputs like fertilizer, seed and application of other SRI principles to wheat crop, which gave very enthusiastic results. SWI is one of the promising technologies to increase productivity which ultimately contributes to the household level food security to marginal farmers. Wheat sown under system of wheat intensifications at 10 cm × 10 cm spacing is better than conventional line sowing in terms of grain and straw yields (Kumar *et al.*, 2015). SWI is more intensive management requires more labor and more organic matter inputs, which raises farmers' costs of SWI production ha^{-1} (Dhar *et al.*, 2016). Wheat sown under SWI is better with proper line to line and row to row spacing than in conventional line sowing in terms of grain and straw yield (Kumar *et al.*, 2015). It was conducted that plant height, numbers of $tillershill^{-1}$, number of productive tillers, spike length and production were found higher in SWI method (Adhikari, 2013).

Continuous use of chemical fertilizers is assumed to be major cause of deterioration of soil health and water pollution. It is also very harmful for plants. To maintain high productivity and sustainability of soil and crop, balanced use of both mineral fertilizer and organic manures is indispensable. Under this condition, there is a great urgency to explore an alternate source, which can supplement partially or wholly the use of costly input i.e. chemical fertilizers and also to protect ecosystem (Bali *et al.*, 1986, Kakar *et al.*, 2001). Integrated nutrient management is the method in which organic and inorganic sources are use in an integrated manner for increasing the crop production and also which is ecologically safe to a certain limit. Nutrient needs of growing plants can be met through a number of sources. The major sources of plant nutrients are mineral fertilizers, organic manures, recycled wastes and by-products, biological nitrogen fixation (BNF), natural minerals and to a lesser extent nutrient recycled through irrigation water and precipitation. These supplemented the soil nutrient reserves for nourishing the crops. Bio-fertilizers, a term, which refers to micro-organisms, which either fix atmospheric N or enhance the solubility of soil nutrients, are becoming increasingly important. Their significance lies in their ability to supplement soil nutrients with mineral use of non-renewable resources and as components of integrated plant nutrition systems. The adoption of SWI methods by maintaining appropriate plant spacing and nutrient management could greatly enhance wheat production in the subtropical region of Bangladesh (Rakib *et al.* 2016). Yield of wheat variety (Bhirkuti) was found 2.6, 2.4 and 2.3 kg 4 m^{-2} in SWI, line sown and broadcast practices, respectively (Adhikari, 2013).wheat variety cv. GW-322 sown in SWI and conventional method results in yield of SWI more than conventional sowing method with yield (32.8 qha^{-1}) (Bhargawa *et al.*, 2016) Application of 50% RDF and 50% N through FYM in rice and 100% RDF in wheat showed best performance in terms of plant height and number of tillers/m^2 (Shivani Ranjan *et al.* 2022).

2. Material and Methods

A field experiment entitled "Effect of integrated nutrient management on yield of wheat (*Triticum aestivum* L.) under system of wheat intensification" was carried out at Experimental Farm, Department of Agriculture, Mata Gujri College, Fatehgarh Sahib at Shamsher Nagar during *Rabi* season of 2017-18. The soil was clay loam in texture with high organic carbon and medium in available N, P and K. The nutrient availability in soil is nitrogen (310 kg/ha), P_2O_5 (15.36 $kgha^{-1}$), K_2O (120 $kgha^{-1}$), organic carbon (0.78%), soil pH (7.2) and electrical conductivity (1.63 dSm^{-1} at 25°C). The research was laid out in a randomized block design with three replications having eleven treatments *viz.*, T_1 - Control, T_2 - 100 % RDF, T_3 - 75 % RDF + FYM @ 5 tha^{-1}, T_4- 75 % RDF + vermicompost @ 2.5 tha^{-1}, T_5 - 75 % RDF + FYM @ 5 tha^{-1} + Vermicompost @ 2.5 tha^{-1}, T_6 - 75% RDF + *Azotobacter* @ 5 $kgha^{-1}$, T_7 - 75% RDF + PSB @ 5$kgha^{-1}$, T_8 - 75% RDF + *Azotobacter* @ 5$kgha^{-1}$ + PSB @ 5kg/ha, T_9 - 50% RDF + Vermicompost @ 5t/ha, T_{10} - 50% RDF + Vermicompost @ 5tha^{-1} + *Azotobacter* @ 5 $kgha^{-1}$ + PSB 5 $kgha^{-1}$, T_{11} - 50% RDF + FYM @10 tha^{-1}. The sowing of wheat variety PBW-725 was done in experimental field on 23 November, 2017. The seed rate in SWI was used @ 25 kg/ha with row to row and plant to plant spacing of 25 x 25 cm. During the sowing only 2 seeds per hill was placed. The regular biometric observations were recorded at periodic intervals of 30, 60, 90 DAS and at harvest stage. The yield parameters were recorded at the time of harvesting of crop. The statistical analysis was done as per standard procedure of design.

3. Results and Discussion

3.1 Effect on growth parameters

The results revealed that the growth parameters such as plant height, dry matter accumulation, and no. of tillers were significantly influenced by different treatments (Table 1) and LAI (Table 2). Among all the treatments the maximum plant height, no. of tillers, dry matter accumulation and LAI was recorded with 75% RDF + FYM @ 5 tha^{-1} + vermicompost @ 2.5 tha^{-1} which was followed by the application of 75% RDF + *Azotobacter*@ 5 $kgha^{-1}$ + PSB @ 5 $kgha^{-1}$ and application of 75% RDF + vermicompost @ 5 tha^{-1} + *Azotobacter* @ 5 $kgha^{-1}$ + PSB @ 5 $kgha^{-1}$. This is due to the reason that the blend of inorganic fertilizers with organic manures has more capacity to provide all the nutrients to plants for their proper growth and development which ultimately have positive effect on yield attributes and yield.

Integrated nutrient management has the capability in improving yield and yield attributes of the crop. Higher nutrient availability leads to higher biomass production which ultimately increases the yield attributing characters. In relation to SWI the no. of effective tillers/ hill were significantly affected by spacing (25 x 25 cm). Wider spacing facilitates plant for better utilization of nutrients, water, light and space leading to the maximum number of effective tillers/hill. Under SWI during ripening stage the plants had larger roots which produced greater xylem exudates and transported these toward shoot at faster rate. These features contributed to maintenance of higher chlorophyll levels, enhanced fluorescence and photosynthesis rate of leaves and supported more favorable yield attributes. The minimum yield attributes was recorded in control plot this was due to inadequate availability of nutrients. Similar results were found in Desai *et al.* (2015) in wheat, Kumar *et al.* (2015) in wheat, Dhar *et al.* (2016) in wheat, Patel *et al.* (2017) wheat.

3.2 Effect on yield parameters

The yield attributing characters were affecting significantly due to various integrated nutrient management treatments (Table 2). Yield is mostly depends upon the growth parameters. Among all the treatments the maximum grain and straw yield was obtained with the application of 75% RDF + FYM @ 5 tha^{-1} + vermicompost @ 2.5 tha^{-1} which was followed by the application of 75% RDF + *Azotobacter* @5 $kgha^{-1}$ + PSB @ 5 $kgha^{-1}$ and application of 75% RDF + vermicompost @ 5 tha^{-1} + *Azotobacter* @ 5 $kgha^{-1}$ + PSB @ 5 $kgha^{-1}$. This is due to the integration of organic manures and inorganic fertilizers which provide higher of amount nutrients to the plants. There was also a positive correlation between yield and yield components like by increase in no. of spikes, effective tillers the grain yield also increased. By increasing dry matter accumulation the straw yield ultimately increased. Adequate spacing under SWI results in high no. of effective tillers which led to increase in biological yield. The minimum yield was recorded in control plot because of the in adequate availability of nutrients. Similar results were found in Kumar *et al.* (2014) in garden pea, Chondie (2015) in wheat, Rakib *et al.* (2016) in wheat, Bharali and Gorth (2017) in wheat and Yadav *et al.* (2018) in wheat. Among all the treatments maximum harvest index was recorded with application of 75% RDF + FYM @ 5 tha^{-1} + vermicompost @ 2.5 tha^{-1} which was followed by the application of 75% RDF + *Azotobacter* @ *5* $kgha^{-1}$ + PSB @ 5 $kgha^{-1}$ and application of 75% RDF + vermicompost @ 5 tha^{-1} + *Azotobacter* @ 5 kg/ha^{-1} + PSB @ 5 kg/ha^{-1}. The harvest index was ultimately increased with the increase in grain and straw yield because it depends upon the economic yield and biological yield. The minimum harvest index was recorded in control plot because of less grain yield and straw yield. Similar results were found in Tiwari *et al.* (2017) in rice, Singh *et al.* (2018) in wheat and Verma *et al.* (2018) in wheat.

Conclusions

From the present study it can be concluded that application of 75% RDF + FYM @ 5 tha^{-1} + Vermicompost @ 2.5 tha^{-1} gave higher results in terms of growth and yield parameters followed by the application of 75% RDF +*Azotobacter* @ 5$kgha^{-1}$ + PSB @ 5$kgha^{-1}$.

Acknowledgement

The author wishes to acknowledge the respondents of the study and also the support received from Mata Gujri college, Fatehgarh Sahib.

Author Contributions: CK, SK and KS prepared the manuscript and helped in preparing the final version of the manuscript and correspond to the journal.

Ethical Approval: This article does not contain any studies involving human or animal participants performed by any of the authors.

Conflicts of Interest: The authors declare no conflict of interest.

References

1. Adhikari D. 2013. System of Wheat Intensification in Farmers' Field of Sindhuli, Nepal. *Agronomy Journal of Nepal* **3**.
2. Bali SV, SC Mudgal and RD Gupta. 1986. Effect of Recycling of Organic Wastes on Rice-Wheat Rotation Under Alfisol Soil Condition of North-Western Himalayas. *Himachal Journal of Agriculture Research* **12**(2): 98-107.
3. Bharali A, D Gorth. 2017. Integrated Nutrient Management in Wheat Grown in Northeast India. *Soil and Tillage Research* **168**: 81-91.
4. Bhardwaj, V Yadav and BS Chauhaii. 2010. Effect of Nitrogen Application Timings and Varieties on Growth and Yield Wheat Grown on Raised Beds. *Achieves of Agronomy and Soil Science* **56**(2): 211-222.
5. Bhargawa C, G Deshmukh, SD Sawarkar, SL Alawa and J Ahirwar. 2016. The System of Wheat Intensification in Comparison with Convention Method of Wheat Line Sowing to Increase Wheat Yield with Low Input Cost. *Plant Archives* **16**(2): 801-804.
6. Chondie YG. 2015. Effect of Integrated Nutrient Management on Wheat (*Triticum Aestivum* L.). *Journal of Biology Agriculture and Healthcare* **5**(13): 2224-3208.
7. Desai HA, IN Dodia, CK Desai, MD Patel and HK Patel. 2015. Integrated Nutrient Management in Wheat (*Triticum aestivum* L.). *Trends in Bioscience* **8**(2): 472-475.
8. Dhar S, BC Barach, AK Vyas and NT Uphoff. 2016. Comparing System of Wheat Intensification with Standard Recommended Practices in The Northwestern Plain Zone of India. *Archives of Agronomy and Soil Science* **62**(7): 994-1006.
9. Kakar KM, M Arif and S Ali. 2001. Effect of NP levels, Seed Rates and Row Spacing on Wheat. *Pakistan Journal of Biological Sciences* **4**(11): 1319-1322.
10. Kumar A, R Raj, S Dhar, UC Pandey. 2015. Performance of System of Wheat Intensification (SWI) and Conventional Wheat Sowing Under North Eastern Plain Zone of India. *Annals of Agriculture Research New Series* **36**(3): 258-262.
11. Kumar R, BC Deka, N Kumavat and SV Ngashan. 2014. Effect of Integrated Nutrition, Biofertilizers and Zinc Application on Production Potential And Profitability Of Garden Pea (Pisum Sativum*)* in Eastern Himalaya, India. *Agriculture Research Communication Centre* **37**(6): 614-620.
12. Patel TG, KC Patel and VN Patel. 2017. Effects of Integrated Nutrient Management on Yield Attributes and Yield of Wheat (*Triticum Aestivum* L.). *International Journal of Chemical Studies* **5**(4): 1366-1369.
13. Prasad R. 2015. Text book of Field Crop Production, Commercial Crops, Krishi Anosandhan Bhawan, Pusa, New Delhi 110012:40-60
14. Rakib RS, N Islam and MA Kader. 2016. Performance of Wheat with System of Wheat Intensification (SWI) Using Different Nutrient Management and Plant Spacing. *International Journal of Natural and Social Sciences* **3**(3): 40-47.
15. Singh G, S Kumar, GS Sidhu and R Kaur. 2018. Effect of Integrated Nutrient Management on Yield of Wheat (*Triticum Aestivum* L.) Under Irrigated Conditions. *International Journal of Chemical Studies* **6**(2): 904-907.
16. Tiwari A, A Tiwari, NB Singh and A Kumar. 2017. Effect of Integrated Nutrient Management On Soil Properties, Yield and Economics of Rice (Oryza sativa L.). *Research in Environment and Life Sciences* **10**(7): 640-644.
17. Verma K, AD Bindra, J Singh, SC Negi, N Datt, U Rana and S Manuja. 2018. Effect of Integrated Nutrient Management on Growth, Yield Attributes and Yield of Maize And Wheat In Maize-Wheat Cropping System In Mid Hills of Himachal Pradesh. *International Journal of Pure & Applied Biosciences* **6**(3): 282-301.
18. Yadav KK, SP Singh, Nishant and V Kumar. 2018. Effect of Integrated Nutrient Management on Soil Fertility and Productivity of Wheat Crop. *Journal of Experimental Agriculture International* **24**(2): 1-9.
19. Ranjan S, S Kumar, SK Dutta, S Sow and M Ghosh. 2022. Effect of Integrated Nutrient Management in Rice on Vegetative Growth and Economic Profitability of Wheat Under Long Term Rice-Wheat Cropping System. *Journal of Cereal Research* **14** (2): 198-203.